Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington D.C. 20554

In the matter of:	)	
	)	
Unlicensed Operation in the TV Broadcast Bands	)	ET Docket No. 04-186
	)	
Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band	)	ET Docket No. 02-380

REPLY COMMENTS OF

Shure Incorporated

SUMMARY

Although it is laudable for the Commission to explore ways to make more spectrum available for unlicensed devices, the initial Comments revealed widespread concern from diverse quarters of the industry regarding the harmful interference that unlicensed device operations will cause to existing users in the TV bands. Shure's close technical analysis -- along with that of other commenters -- demonstrates that the Commission's proposal as set forth in the NPRM does not adequately protect existing users of the TV bands from harmful interference that would be caused by the introduction of unlicensed devices. Numerous parties agreed, in particular, that the Commission cannot rely on the assumptions stated in the NPRM to safeguard wireless microphone devices. No party offered credible evidence or analysis refuting these interference concerns. As such, it is apparent that the Commission cannot meet its objectives in this proceeding by adopting the proposal set forth in the NPRM. Those objectives are, as stated in the NPRM, to allow unlicensed devices to operate in the TV bands *as long as no harmful interference occurs to licensed services*. For these reasons, Shure cannot support the proposal as set forth in the NPRM.

Shure has nonetheless provided ongoing constructive input to the Commission to develop interference measures that would be sufficient to protect important existing uses of the broadcast spectrum in the event that the Commission decides to allow unlicensed device operations in the TV bands. In particular, Shure has developed a three-part interference mitigation solution and other measures that would protect the wide variety of important wireless microphone uses. Specifically, in addition to adopting specific measures outlined in Shure's filings, the Commission should:

(1) identify two VHF TV channels and four UHF TV channels to be exempt from unlicensed device operations;

(2) require unlicensed devices to employ spectrum sensing/dynamic frequency selection techniques to prevent transmission in TV channels that are occupied by incumbent users, including television broadcasting stations, wireless microphones, and wireless audio systems; and

(3) implement an RF "smart beacon" transceiver to enhance the interference prevention capabilities of spectrum sensing at greater distances.

The comments show broad support – both by the wireless microphone community and by others – for the interference mitigation techniques proposed by Shure or similar concepts. If the Commission decides to permit unlicensed operations in the TV bands, Shure urges the Commission to adopt the interference mitigation measures described in detail in Shure's filings and avoid a situation in which unlicensed devices are widely disseminated to the "mass market" only to find later that they cause harmful interference to existing services. Shure submits that such a scenario would not serve the interest of consumers, any of the affected industry segments, or the larger public interest.

Shure believes that certain measures proposed by other commenters would aggravate the interference problem. In particular, proposals for power levels significantly higher than the already high levels proposed in the NPRM should be rejected. Similarly, the Commission should reject the request for out-of-band emission levels above levels permitted in Part 15 of the Commission's Rules. Indeed, as a result of Shure's ongoing study of the effects of harmful interference to wireless microphones

by Personal/Portable unlicensed devices, Shure has concluded that the power levels proposed in the NPRM are too high to ensure adequate protection and the Commission should consider a reduced power level for such unlicensed operations. Additionally, if the Commission decides to permit unlicensed devices in the TV bands, Shure urges the Commission to consider a phase-in implementation starting with Fixed/Access systems to further ensure that unlicensed operations will not adversely affect existing licensed uses. Should the Commission conclude to introduce unlicensed devices to the TV band, the best scenario would be a phased introduction of new unlicensed services beginning after the DTV transition has completed because this affords the industry adequate opportunity to build and test unlicensed devices for their ability to avoid interfering with incumbent services, in addition to developing interference protection measures. Finally, Shure recommends that any technical rules adopted in this proceeding be codified into the Commission's Rules to facilitate compliance and enforcement.

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REPLY COMMENTS OF

Shure Incorporated

INTRODUCTION

Shure Incorporated ("Shure") is pleased to submit reply comments in this important proceeding.[1] Although it is laudable for the Commission to seek to make more spectrum available for unlicensed devices, Shure's analysis -- along with that of other commenters – shows that the Commission cannot fulfill the public interest objectives of this proceeding by adopting the rules as proposed in the NPRM. Those objectives, as stated in the NPRM, are to allow unlicensed devices to operate in the TV bands as long as no harmful interference occurs to licensed services.[2] However, as shown by Shure's technical analysis[3] and by other parties in their submissions, the Commission's proposals set forth in the NPRM do not adequately protect existing users of broadcast spectrum from harmful interference. Thus, Shure cannot support the

[1] *Unlicensed Operation in the TV Broadcast Bands*, ET Docket Nos. 04-186, 02-380, Notice of Proposed Rulemaking (released May 25, 2004) ("NPRM").
[2] *See, e.g.*, NPRM, ¶ 2 ("To ensure that no harmful interference to authorized users of spectrum will occur, we propose to define when a TV channel is 'unused' and to require these unlicensed devices to comply with significant restrictions and technical protections.").
[3] *See generally* Comments of Shure Incorporated filed in ET Docket No. 04-186 on November 30, 2004 ("Shure Comments").

proposal as set forth in the NPRM. To the extent that the Commission concludes nonetheless to allow unlicensed devices to operate in the TV bands, Shure urges the Commission to adopt interference protection measures, as described below, that are sufficient to preserve existing important uses of the broadcast spectrum.

In its initial comments and in *ex parte* submissions, Shure has set forth its technical data and analysis demonstrating that the Commission cannot rely on the assumptions stated in the NPRM to safeguard wireless microphones from harmful interference from unlicensed devices. In an effort to provide constructive assistance to the Commission as it grapples with the complex issues raised by unlicensed operation in the TV bands, Shure developed a three-part interference mitigation solution that would protect the wide variety of important wireless microphone uses from harmful interference from unlicensed devices, consistent with the goals of the NPRM. Specifically, Shure urges the Commission: (1) to identify two VHF TV channels and four UHF TV channels to be exempt from unlicensed device operations; (2) to require unlicensed devices to employ spectrum sensing/dynamic frequency selection techniques to prevent transmission in TV channels that are occupied by incumbent users, including television broadcasting stations, wireless microphones, and wireless audio systems; and (3) to implement an RF "smart beacon" transceiver to enhance the interference prevention capabilities of spectrum sensing at greater distances.

As described more fully below, the comments show broad support – both by the wireless microphone community and by others – for the interference mitigation techniques proposed by Shure. The comments also show widespread concern across various broadcast industry segments that the Commission's interference mitigation

proposals are flawed and inadequate to protect existing services. While the unlicensed device community is obviously energized at the prospect of having access to the TV bands, they failed to show how unlicensed devices and broadcast services could coexist and largely merely affirmed the Commission's proposals.

Introducing "mass market" unlicensed devices only to have them interfere with existing services would not serve the public interest. Thus, if the Commission determines to allow unlicensed device operation in the TV bands, the Commission must significantly modify its proposed technical rules to meet the stated goals of the NPRM. Shure believes that certain solutions proposed by other commenters would be inadequate to remedy harmful interference. Moreover, in response to comments filed by other parties, Shure has further studied the effects of harmful interference to wireless microphones by Personal/Portable unlicensed devices and has concluded that the 100mW power levels proposed in the NPRM are too high to ensure adequate protection. Therefore, Shure is submitting a new proposal for Personal/Portable power levels as outlined in detail below. Accordingly, Shure maintains that, if the Commission allows unlicensed devices to expand into the TV bands, the Commission could achieve a "win-win" result and fulfill the dual purposes of this proceeding by adopting Shure's three-part solution as discussed herein. Additionally, Shure urges the Commission to consider a phase-in implementation of unlicensed devices to further ensure that they will not adversely affect existing licensed uses. Should the Commission conclude to introduce unlicensed devices to the TV band, the best scenario would be a phased introduction of new unlicensed services beginning after the DTV transition has completed because this affords the industry adequate opportunity to build and test

unlicensed devices for their ability to avoid interfering with incumbent services, in addition to developing interference protection measures. Finally, Shure recommends that any technical rules adopted in this proceeding be codified into the Commission's rules to facilitate compliance and enforcement.

DISCUSSION

I. THE COMMENTS DEMONSTRATE WIDESPREAD SUPPORT FOR THE INTERFERENCE MITIGATION TECHNIQUES PROPOSED BY SHURE.

A. Numerous Comments from Various Sectors of the Wireless Microphone Industry Show How Important and Pervasive These Devices Are.

Shure is pleased to observe that many sectors of the wireless microphone community submitted initial comments in response to the Commission's NPRM.[4] While Shure has been very active in this proceeding on behalf of wireless microphone interests, it is clearly not alone in its concerns. These varied interests show how pervasive wireless microphones are in the broadcast and video arena today.

Numerous commenters agree with Shure that the Commission understates in the NPRM the potential for harmful interference to wireless microphones from unlicensed

[4] Various wireless microphone manufacturers, high-end wireless microphone users and large scale event planners, and trade associations related to the wireless microphone industry submitted initial comments in this proceeding expressing serious concerns with the NPRM. *See, e.g.*, Comments of Audio-Technica U.S. Inc. filed in ET Docket No. 04-186 on November 29, 2004 (wireless microphone manufacturer expressing concern with NPRM) ("Audio-Technica Comments"); Comments of James Stoffo filed in ET Docket No. 04-186 on November 30, 2004 (well-respected event producer explaining importance of wireless microphones) ("Stoffo Comments"); Comments of NAMM, the International Music Products Association filed in ET Docket No. 04-186 on November 30, 2004 (trade association for musical instruments and electronic products, describing importance of wireless microphones to musicians) ("NAMM Comments"); Comments of Professional Audio Manufacturers Alliance filed in ET Docket No. 04-186 on November 29, 2004 (describing concerns of audio industry trade association with NPRM proposals) ("PAMA Comments"); Comments of National Systems Contractors Association filed in ET Docket No. 04-186 on November 30, 2004 (trade association for the commercial electronics systems industry expressing concerns with NPRM if adequate protections are not afforded wireless microphones) ("NSCA Comments"); and Comments of International Communications Industries Association, Inc. filed in ET Docket No. 04-186 on November 30, 2004 (noting far-reaching important uses of wireless microphones and concerns with NPRM) ("ICIA Comments").

devices. For example, Audio-Technica states that the Commission "overstates both the capability of smart radio technology to avoid interference and the ability of FM capture effect to prevent interference from unlicensed devices."[5] Refuting the Commission's assumption that the operating range of wireless microphones "would typically be hundreds of feet at the most,"[6] the Society of Broadcast Engineers observes that "many productions frequently employ long-distance telephoto shots that rely on wireless microphones to capture usable dialog. The received FM wireless microphone signal is weak under such conditions and would be especially prone to interference from co-channel high power Part 15 devices."[7] Total RF Marketing has "experienced 'first hand' that radiation from certain unlicensed devices has the propensity to adversely impact our ability to provide interference free, broadcast quality audio to our client."[8] Other commenters reiterate how far-reaching and potentially devastating it would be to have harmful interference from unlicensed devices degrade wireless microphone performance. NAMM asserts that "[w]ireless microphones and wireless audio systems have become so important that most broadcast events and public performances could not be presented without them."[9] Further, James Stoffo observes that allowing the NPRM to proceed would cause "the professional audio and TV production business to technically regress to the point that it was forty years past."[10]

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[5] Audio-Technica Comments at p. 6.
[6] *See NPRM*, ¶ 38.
[7] Comments of the Society of Broadcast Engineers, Inc. filed in ET Docket No. 04-186 on November 30, 2004 at p. 7 ("SBE Comments").
[8] Comments of Total RF Marketing, Inc. filed in ET Docket No. 04-186 on November 30, 2004 at p. 6 ("Total RF Comments").
[9] *See, e.g.*, NAMM Comments at p. 2; Stoffo Comments at p. 2.
[10] Stoffo Comments at p. 2. Stoffo also points out some more serious consequences of harmful interference to wireless microphones – noting that such interference could damage the hearing of the artist, cause loud sound bursts onto the sound carrier of the broadcast, or create safety issues that may result in injury to back stage personnel. *Id.*

In addition to pointing out the urgent need for the Commission to require interference protection for wireless microphones, many commenters also support Shure's three-part solution. Specifically, to mitigate potential interference, Shure proposed that the Commission should (1) identify two VHF TV channels and four UHF TV channels to be exempt from unlicensed device operations; (2) require unlicensed devices to employ spectrum sensing/dynamic frequency selection techniques in a distributed, cognitive fashion; and (3) implement a "smart" beacon system that would operate on one of the vacant TV channels being used by the wireless microphone system and transmit information concerning the TV channels in use by various wireless microphone systems. This proposal was supported by ATK AUDIOTEK, Total RF, and James Stoffo, among others.[11] Significantly, commenters outside the wireless microphone community also support the concepts advanced by Shure to mitigate interference.[12] IEEE describes a distributed spectrum sensing solution to mitigate interference to wireless microphones, noting that a beacon system would provide an additional means of interference protection.[13] The spectrum access protocol advanced by Metropolitan Area Networks, Inc. is similar to Shure's spectrum sensing proposal.[14] While Shure recommends that spectrum sensing techniques be used in conjunction with

[11] *See* Comments of ATK AUDIOTEK filed in ET Docket No. 04-186 on November 30, 2004 at pp. 6-7 ("ATK Comments"); Total RF Comments at pp. 8 – 10; Stoffo Comments at p. 3. Michael Mason also supports all elements of Shure's interference mitigation solution. Comments of Michael Mason filed in ET Docket No. 04-186 on November 30, 2004 at p. 3 ("Mason Comments"). Audio-Technica also supports all primary elements of Shure's proposal, but does not advocate designating as many exempt channels as Shure believes necessary.

[12] *See, e.g.* Comments of IEEE 802 filed in ET Docket No. 04-186 on November 30, 2004 at pp. 13-14, 37 ("IEEE Comments"); Comments of Metropolitan Area Networks, Inc. filed in ET Docket No. 04-186 on November 30, 2004 at pp. 3 (discussing common signaling mode proposal) ("MAN Comments").

[13] *See* IEEE Comments at p. 14.

[14] *See* MAN Comments at pp. 3-4 ("MAN Comments").

other interference mitigation measures, Intel and Wi-Fi Alliance are also in favor of spectrum sensing techniques to avoid interference to licensed users.[15]

B. Many Commenters Support Making More Efficient Use of Television Spectrum and Agree, Consistent with the NPRM, that Preserving Existing Spectrum Uses Is Essential for Any "Win-Win" Solution.

The dual goals of the NPRM are (1) to allow unlicensed devices to operate in the TV bands, (2) without causing harmful interference to licensed services. The NPRM states:

> While we understand the concerns of broadcasters and other existing authorized users of the TV bands about the possibility of new interference, we believe that with appropriate safeguards it would be possible to allow unlicensed operation in the TV bands *without causing new harmful interference to television services, disrupting the DTV transition, or adversely affecting the other services that use this spectrum.*[16]

Importantly, the NPRM does not propose to introduce unlicensed devices without regard to their impact on other licensed services, or to the detriment of other licensed services. Rather, the stated purpose and public interest objectives of the NPRM are the introduction of unlicensed devices to the TV bands along with "appropriate safeguards" to protect existing spectrum uses.

In light of the plain language of the NPRM, numerous commenters recognize that preserving existing spectrum uses is essential for realizing a "win-win" result. For example, the Consumer Electronics Association "supports the Commission's intention in this proceeding to allow unlicensed device operation in vacant TV broadcast bands while ensuring that TV broadcast is fully protected from interference."[17] Motorola

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[15] *See* Comments of Intel Corporation at ii (agreeing that sensing is one method that can be used in combination with other techniques to avoid harmful interference) ("Intel Comments"); Comments of the Wi-Fi Alliance filed in ET Docket No. 04-186 on November 30, 2004 at p. 4 ("Wi-Fi Alliance Comments").
[16] NPRM, ¶ 15 (emphasis added).
[17] Comments of Consumer Electronics Association filed in ET Docket No. 04-186 on November 30, 2004 at p. 2 ("CEA Comments").

realizes the balance the Commission must strike in this proceeding, stating its support for "use of the TV broadcast bands by unlicensed devices on most channels [...] while ensuring that incumbent operations are not impacted."[18] Even the most enthusiastic proponents of the Commission's proposal agree that unlicensed devices are to be introduced without adversely affecting existing services. WISPA states that "WISPs are dedicated to the use of the unused TV spectrum for the non-interfering provision of network services."[19] Despite this consensus on the need to avoid interference, the comments show that the Commission's proposal to introduce unlicensed devices to the TV bands would cause harmful interference to licensed spectrum users, in contravention of the stated goals of the NPRM.

II. THE COMMENTS SHOW THAT SEVERAL EXISTING SERVICES ARE AT RISK FOR HARMFUL INTERFERENCE FROM UNLICENSED DEVICES

Several commenters agree with Shure that, based on the NPRM, existing services are at tremendous risk for harmful interference from unlicensed devices. Not only do the proposed rules fail to protect wireless microphone operation, but they also fail to protect other licensed services, such as Low Power and Class A TV stations and translators. The Community Broadcasters Association warns that "[t]he Commission must also not treat the interference issue casually on the theory that most of the public receives television broadcasting by cable or satellite, because that assumption is not universally valid and is especially not valid with respect to Class A/LPTV systems."[20] Commercial Broadcasting Corp. shares this concern, noting that "[t]he definition of

[18] Comments of Motorola, Inc. filed in ET Docket No. 04-186 on November 30, 2004 at p. 1 ("Motorola Comments").
[19] Comments of WISPA filed in ET Docket No. 04-186 on November 24, 2004 at p. 14 ("WISPA Comments").
[20] Comments of Community Broadcasters Association filed in ET Docket No. 04-186 on November 30, 2004 at p. 1 ("CBA Comments").

'unused' broadcast channels in [the NPRM] includes the area within the Grade B contour of both Class A and LPTV stations" and that "the population within the Grade B contour in a top 25 market may be as high as 50% of the viewing public."[21]

Even viewers of full power TV stations living beyond, and in some cases within, the Grade B contours of those stations would be subject to interference under the proposed rules in the NPRM. As Colorado Public Television ("Colorado"), licensee of KBDI Channel 12, explains -- "[w]hile we are concerned whether the proposed mechanism of databases of vacant channels controlling the 'unlicensed radiators' is really practical in everyday use, our greatest concern is that the definitions of protected areas for both primary stations and translators is woefully inadequate."[22] In support of its comments, Colorado provided maps showing the remarkable disparity between the predicted F(50,50) Grade B contour, and coverage based on OET Bulletin 69 Longley-Rice. Colorado further observes that "[i]t is well known that the coverage contours based on the FCC F(50,50) curves are not accurate predictors of the coverage of a station in practice. The contours are based only on the terrain from 2 to 10 miles and ignore any terrain features at lesser or greater distances."[23] Similarly, the Society of Broadcast Engineers observes that the "inherent receiver blindness of polite protocol devices would have the potential to cause interference to viewers in rural areas attempting to receive service from distant full power TV and DTV stations, or from low power TV translator and LPTV stations."[24]

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[21] Comments of Commercial Broadcasting Corp. filed in ET Docket No. 04-186 on November 30, 2004 at p. 1 ("Commercial Broadcasting Corp. Comments").
[22] Comments of Front Range Educational Media Corporation d/b/a Colorado Public Television filed in ET Docket No. 04-186 on November 30, 2004 at p. 1 ("Colorado Comments").
[23] *Id.*, at p. 2.
[24] SBE Comments at p. 5.

Even those Americans who receive their TV programs from cable and satellite services could be adversely affected if the Commission adopts its proposed rules. In particular, set-top boxes and TV sets would be vulnerable to Direct Pickup interference caused by the high field strengths of nearby unlicensed devices. The Consumer Electronics Association recognizes the potential for interference due to direct pickup in cable television receiving equipment, explaining that "[t]he population of potential devices suffering from interference is no longer limited to broadcast receivers. It extends to all TVs and VCRs connected to cable systems and potentially to all receivable TV channels."[25] Personal/Portable unlicensed devices are especially problematic because they would very likely be used in close proximity to TV sets and set top boxes. The Consumer Electronics Association further observes that "the proposed 100 mW power limit is guaranteed to create interfering field strengths that exceed the Commission's own benchmark of 100 mV/m direct pickup immunity in 47 C.F.R 15.118. The result is the potential for widespread interference to cable television reception from devices that are fully compliant with longstanding Commission rules."[26] In addition, the Consumer Electronics Association included measurements of a 100 mW transmitter in its test plan, the results of which were presented in its comments. Based on the predicted interference, the Consumer Electronics Association recommends reducing the power proposed in the NPRM for Personal/Portable unlicensed devices to 20mW to avoid widespread interference issues.[27]

Television broadcasters were not the only groups to recognize problems with the proposed rules. Public safety entities also expressed concerns about interference to

[25] CEA Comments at p. 3.
[26] *Id.,* at p. 5.
[27] *Id.*, at p. 12.

public safety frequencies in TV channels 14-20; not only in the 13 markets where these channels are designated for Public Safety use, but nationwide. The County of Los Angeles questions how the Commission's proposed requirement to limit unlicensed device operation to specific geographic areas would be accomplished, arguing that "the technology to facilitate such requirements is untested, with no historical basis on which to judge the potential for tampering, malfunction, or other technical problems that could permit unauthorized operation of either fixed or portable devices anywhere within the U.S."[28]

Even the Commission seems to have some doubts about the ability of its proposed limitations on unlicensed device use to protect public safety operations. The NPRM proposed to prohibit the operation of unlicensed devices in areas where a particular channel is used for CMRS or PLMRS operation. This prohibition was based on public safety arguments that (1) it would be difficult for unlicensed devices to avoid interference to PLMRS and CMRS operations because many transmitters in those services are mobile, so their exact locations do not and cannot appear in a database; and (2) transmitters in these services operate intermittently and unpredictably, making a "listen-before talk" protocol ineffective for unlicensed devices to avoid causing interference to these services.[29] Shure notes that wireless microphone operation is analogous in many ways to the operation of public safety radios in that the transmitters are mobile, making the use of a database to list their exact location impractical. In addition, wireless microphones are also operated intermittently and unpredictably. In

[28] Comments of the County of Los Angeles filed in ET Docket No. 04-186 on November 30, 2004 at p. 2 ("LA Comments").
[29] *See* NPRM, ¶ 35 (citations omitted).

light of these similarities, Shure believes that the concerns raised by the public safety community also apply to wireless microphones.

Radio astronomy facilities consider various television frequencies to be critical to their operations, and they have also expressed concerns about interference from unlicensed devices. These frequencies include the 74 MHz band between TV channels 4 and 5, the 632-638 MHz band (TV channel 37), and the 1400-1427 MHz band (harmonically related to TV channels 14 and 52-54).[30] Their concerns also extend to adjacent TV channels because of the spurious emissions of unlicensed devices operating on those channels. Adequately protecting these important bands will place additional regulatory burdens on the Commission if it decides to proceed with opening the TV bands to unlicensed operation.

The concerns stated by numerous commenters show that the interference protection measures proposed by the Commission in the NPRM are inadequate to protect a variety of licensed services. For example, as shown by Shure and other commenting parties, a broadcast control signal would be impractical for protecting wireless microphones due to the difficulty of keeping the underlying database accurate and up to date on a continuous basis.[31] Ensuring that the control signal is receivable at the proper locations is another problem that has yet to be resolved. Finally, a broadcast control signal is a "broad brush" technique that does not allow efficient spectrum use in small zones. As Shure explained in its initial comments, Shure believes the use of a

[30] Comments of the National Radio Astronomy Observatory filed in ET Docket No. 04-186 on August 26, 2004 at p. 2 ("NRAO Comments").

[31] *See, e.g.*, Comments of Harris Corporation filed in Docket No. 04-186 on November 30, 2004 at pp. 8-9 ("Harris Comments"); Comments of Sennheiser Electronics Corp. filed in Docket No. 04-186 on November 30, 2004 at p. 3.

local wireless microphone beacon, in combination with spectrum sensing, is a better approach.

III. INTRODUCING "MASS MARKET" UNLICENSED DEVICES ONLY TO HAVE THEM INTERFERE WITH EXISTING SERVICES WOULD NOT SERVE THE PUBLIC INTEREST

The Commission's proposals raise the specter of a multitude of interference problems of a serious and potentially irresolvable nature, once unlicensed devices have been distributed to the public in large numbers. Rushing to introduce unlicensed devices to the TV band, only to have them interfere with licensed services, would not serve the public interest. Other commenters share our view that because of the "mass market" nature of unlicensed devices, it will be extremely difficult to recall them once they have been widely distributed to the public. Therefore, the Commission must "get it right" the first time and make certain that these devices will not interfere. Cox Broadcasting cautions that "[c]oncerns about significant interference are not fanciful. The Commission has every reason to presume widespread commercial use of new unlicensed devices, so interference problems could be pervasive if they occur."[32] The Society of Broadcast Engineers echoes these concerns, observing that "[o]nce a high power Part 15 device has been sold neither the seller nor the Commission has any control over when, where or how that device will be used."[33]

Furthermore, harmful interference would be extremely difficult to track down and resolve, whether experienced by an FCC licensee or an unlicensed device user. In most cases, the public will not be able to determine the cause of interference, even if it is under their control. If the interference is coming from an unlicensed device being

[32] Comments of Cox Broadcasting Inc. filed in ET Docket No. 04-186 on November 30, 2004 at p. 8 ("Cox Comments").
[33] SBE Comments at p. 8.

operated by a member of the public, the problem is compounded. In many cases, it would be impossible to locate and gain access to the interfering device to turn it off. MSTV observes that "[r]arely will broadcasters, the Commission, or the public even be aware of harmful interference from unlicensed devices, because most cases of interference from unlicensed devices will go unreported. If unable to receive a station's signal, viewers may simply assume that the interference is caused by a problem with the broadcaster's transmission or their sets."[34] Qualcomm takes this concern to the next level, explaining how once interference is detected, it will be too late to resolve it:

> It is not clear how interference from unlicensed devices can be pinpointed, especially once thousands and potentially millions of the devices are operating on a mobile basis. There is no mechanism in place for the recall of millions of such devices. Once they spread around the country, it will be too late to mitigate the interference.[35]

Because wireless microphones, in particular, are integral parts of a variety of live productions, trying to remedy interference once it occurs is simply not an option. Live productions will be degraded or even ruined by harmful interference to wireless microphones. Therefore, it is critical that the Commission "get it right" the first time and ensure that unlicensed devices will not interfere with licensed services before such devices are permitted to operate in the TV bands.

Significantly, the wireless microphone industry has presented substantial and well documented evidence that if the Commission proceeds with its proposal as written, widespread harmful interference to wireless microphones and wireless audio devices

[34] Joint Comments of the Association for Maximum Service Television, Inc. and the National Association of Broadcasters filed in ET Docket No. 04-186 on November 30, 2004 at p. 16 ("MSTV Comments").
[35] Comments of Qualcomm Incorporated filed in ET Docket No. 04-186 on November 30, 2004 at iii ("Qualcomm Comments").

will occur.[36] Conversely, the unlicensed device community has failed to demonstrate that their devices can successfully coexist with existing services, and largely merely affirmed the Commission's proposals or expressed an intent to rely on unproven interference mitigation techniques. While Microsoft does specifically address wireless microphones – and many commenters do not -- Microsoft largely parrots back the incorrect assumptions from the NPRM about wireless microphones' susceptibility to interference from unlicensed devices.[37] Based on the credible, unrefuted technical evidence and analysis placed in the record by numerous parties regarding the harmful interference that would result to licensed services from introducing unlicensed devices in the TV band, the Commission cannot move forward with the NPRM as proposed.

There is no easy fix to resolve the harmful interference Shure and others have shown will occur if unlicensed devices were to be introduced in the TV bands as proposed in the NPRM. Shure observes that cognitive radio techniques are increasingly being touted as a panacea to remedy interference issues. Although the concept of cognitive radios is developing, no prototypes of unlicensed devices employing such techniques have been built, and no experiments have been conducted to demonstrate that they can effectively prevent interference to existing services, including wireless microphones and television broadcasting. These technologies must be demonstrated and proven before the Commission allows unlicensed devices to operate in the TV bands. Qualcomm asserts that "[t]here are no interference sensing radios available today that can be put into unlicensed devices to ensure the absence of

[36] *See generally* Shure Comments.
[37] *See, e.g.*, Comments of Microsoft Corporation filed in ET Docket No. 04-186 on November 30, 2004 at p. 25 ("Microsoft Comments").

interference."[38] Shure agrees with Qualcomm's conclusion that "[t]he Commission should not authorize unlicensed devices in the TV bands until the interference issues are definitively resolved—not just on paper, but in the real world."[39]

Shure believes that cognitive radio techniques do offer promise for preventing interference, particularly from Personal/Portable devices. This protection is essential, due to the projected widespread and pervasive deployment of these devices. However, until it can be demonstrated that cognitive radio technology is, in fact, effective in preventing interference to wireless microphones and other incumbent services, it is Shure's position that it is premature for the Commission to proceed with the authorization of unlicensed Personal/Portable devices in the TV bands.[40]

IV. SHURE BELIEVES CERTAIN PROPOSALS OFFERED BY OTHER COMMENTERS EITHER WOULD BE INADEQUATE TO REMEDY INTERFERENCE OR, IN SOME CASES, WOULD INCREASE THE POTENTIAL FOR HARMFUL INTERFERENCE

Some commenters have asked for power levels significantly higher than the 1 Watt conducted/4 Watt EIRP limit proposed for Fixed/Access devices in the NPRM.[41] The Wireless Broadband Operators Coalition has asked the Commission to allow unlicensed devices to operate with *unlimited* instantaneous power, based on a concept of "Maximum Average Interference Power."[42] Shure vigorously opposes this and other proposals for high power operation, because high peak power levels pose significant

[38] Qualcomm Comments at iii.
[39] *Id.,* at p. 11.
[40] *See* Comments of Red River Broadcasting Company L.L.C. filed in ET Docket No. 04-186 on November 30, 2004 at p. 2 ("Red River Comments") ("In light of the uncertainty surrounding these technologies, the Commission should withhold further consideration of this proceeding until additional, more comprehensive, studies are conducted to demonstrate their effectiveness.").
[41] *See, e.g.,* Comments of CWLab filed in ET Docket No. 04-186 on November 30, 2004 at p. 3.
[42] Comments of Wireless Broadband Operators Coalition filed in ET Docket No. 04-186 on November 30, 2004 at p. 5.

interference risks for wireless microphones, as well as other incumbent users of the television spectrum (*e.g.,* television receivers and other types of consumer products).

The spectrum study conducted by Shared Spectrum Company illustrates Shure's concern with allowing high-power unlicensed device operation in the TV band. Specifically, Shared Spectrum Company took measurements from the rooftop of a building in Hoboken, New Jersey from August 31 – September 3, 2004, during the Republican National Convention. Hundreds of wireless microphones and wireless audio devices were known to be in operation at the Republican National Convention during the time of the study. The study, however, did not record evidence of this activity,[43] clearly demonstrating that the weak signals of a low powered wireless microphone transmitter do not propagate very far, especially when they are emanating from an indoor location in an urban area. This is a matter of concern, since a high powered opportunistic unlicensed device could easily assume that a TV channel was available and operate on it, inadvertently causing interference to a wireless microphone that it could not sense.

[43] Comments of Shared Spectrum Company filed in ET Docket No. 04-186 on November 30, 2004 ("Shared Spectrum Comments"). Use of the television spectrum for unlicensed device operation is predicated on the availability of vacant spectrum—a factor that Shure believes is vastly overstated, particularly in major metropolitan areas. "Shared Spectrum's bottom-line conclusion is that, even in this severe congestion, no more than 16% of the spectrum was employed." *Id.*, at p. 2. It is important to note that the claim of only 16% occupancy was based on measurements that spanned the entire range of spectrum from 30 MHz to 2.9 GHz. The instant NPRM is concerned specifically with the television spectrum, which represents only a very small portion of the spectrum studied – approximately 14.2%. Thus, this study was too broad to constitute a meaningful examination of vacancy in the TV bands. Even if the television spectrum had been 100% occupied during the study that would amount to less than 16% of the total.

Shure believes the other spectrum study presented in initial comments also overstates the amount of available vacant TV spectrum. Comments of Adaptrum Incorporated filed in ET Docket No. 04-186 on November 30, 2004. Adaptrum's study was conducted to demonstrate that there are many available TV channels in the San Francisco Bay area because broadcast signals are weak. It is well known that the Bay area presents extreme challenges to broadcast television reception due to terrain roughness, and this is atypical for the majority of the country where the terrain is relatively flat. Furthermore, it is not possible to determine the height of the test-receiving antenna from the report presented, and this could have had a significant impact on Adaptrum's results.

Accompanying Shure's concern with allowing high-power unlicensed operation is the request from some commenters to raise the level of out-of-band emissions above those specified in Section 15.209(a) of the Rules. As discussed in Shure's initial comments and reiterated below, the emissions limits of 15.209(a) can introduce harmful interference to wireless microphones at distances between the unlicensed device and a wireless microphone receiver of only three meters. Therefore raising the emissions levels above those in 15.209(a) would only increase harmful interference from unlicensed devices to wireless microphones, particularly from Personal/Portable devices since the location of these devices cannot be known or controlled within a venue where wireless microphones are routinely operated. Motorola conducted simulations which demonstrate that emission limits, even at levels within Section 15.209(a), are 20-30 dB too high to adequately protect over-the-air television reception within the protected contour and urged the Commission to lower the out-of-band emission levels allowed from new unlicensed devices below the 15.209(a) limits by similar amounts.[44]

While other commenters agree with Shure that spectrum sensing should serve as one of the solutions to mitigate harmful interference from unlicensed devices to wireless microphones and other licensed services, a critical component of any spectrum sensing solution is how frequently channels are scanned to determine occupancy. Intel, for example, proposes to scan for channel occupancy only one time per day.[45] This would be insufficient to protect to wireless microphone operation. As Shure has explained, wireless microphone transmissions are itinerant and may only be present for

[44] Motorola Comments at p. 12.
[45] Intel Comments at App. B, p. 3.

a few hours at a time. Thus, more frequent scanning is needed. Shure recommends that spectrum sensing be performed according to the Dynamic Frequency Selection (DFS) parameters proposed in its comments. Shure developed these parameters specifically taking into account the typical use models of wireless microphones.[46]

Some parties advocate that the Commission should designate only one or two TV channels to be exempt from unlicensed device operation.[47] Exempting one or two TV channels is woefully inadequate to provide the amount of spectrum required to produce events such as political, commercial, or public television, or radio programs. Special events, such as political conventions and the Super Bowl would not be able to be produced with only one or two exempt channels. Shure and several other commenters have brought forward examples of spectrum requirements that clearly demonstrate the need to designate six TV channels in each television market to be used by wireless microphones that would be exempt from unlicensed device operations.[48]

V. BASED ON SHURE'S TECHNICAL ANALYSIS, SHURE RECOMMENDS THE FOLLOWING CHANGES TO THE PROPOSED RULES TO PROTECT EXISTING USES CONSISTENT WITH THE GOALS OF THE NPRM

In order to protect wireless microphones from harmful interference caused by unlicensed devices, the three-part solution suggested by Shure in its comments must be implemented.[49] Several commenters agreed with the need for six exempt channels in each market in which unlicensed devices would not be allowed to operate.[50] In addition, many commenters agreed with the importance of spectrum sensing as an interference

[46] Shure Comments at p. 56.
[47] *See, e.g.*, WISPA Comments at p. 33.
[48] *See, e.g.*, ATK Comments at p. 6; Total RF Comments at pp. 8-9.
[49] Shure Comments at pp. 18-19.
[50] *See, e.g.*, ATK Comments at p. 6; Total RF Comments at pp. 8-9.

mitigation technique, and for including a requirement for unlicensed devices to receive and respond to a local wireless microphone beacon.[51] As Shure explained in its comments, all the three parts of this solution are necessary to address the different use models of wireless microphones – ensuring adequate protection while avoiding overbroad and wasteful spectrum protection.

Notwithstanding Shure's three-part interference mitigation solution, Shure believes that test standards must be developed for unlicensed devices before they are approved and permitted to operate in the TV bands.[52] Several commenters, including Shure, indicated a willingness to help develop those standards.[53]

In addition to adopting the three-part solution, the Commission should adopt certain detailed implementation measures specific to Fixed/Access and Personal/Portable devices.

A. Fixed/Access Devices

Technical Parameters. Fixed/Access unlicensed devices (both base stations and CPEs) should be limited to a power level of 1W RMS conducted or 4W RMS EIRP for bandwidths of 2.5 MHz or greater.[54] Power must be measured on an RMS basis – high instantaneous peak power will have very detrimental effects on wireless microphone receivers, as well of those of other services (*e.g.,* TV reception). For bandwidths below 2.5 MHz, the output power should be limited according to the graph presented by Shure

[51] IEEE Comments at p. 14; Total RF Comments at pp. 9-10; ATK Comments at pp. 6-7; Mason Comments at pp. 2-3; NAMM Comments at pp. 4-5; and PAMA Comments at p. 5.
[52] *See, e.g.,* Cox Comments at p. 9; Comments of Entravision Holding LLC filed in ET Docket No. 04-186 on November 30, 2004 at p. 10 ("Entravision Comments").
[53] *See, e.g.*, Shure Comments at p. 48; Comments of Telex Communications, Inc. filed in ET Docket No. 04-186 on November 30, 2004 at p. 4 ("Telex Comments").
[54] *See, e.g.,* IEEE Comments at p. 17; ATK Comments at p. 8.

in its comments.[55] This recommendation is essential to maintain a reasonable power spectral density for the Fixed/Access devices, which helps mitigate the amount of unlicensed device interference to an incumbent receiver. Fixed/Access devices should still be required to use continuous spectrum sensing to avoid interfering with wireless microphones at a sensing level of –107dBm (within 200kHz bandwidth) or greater using a 0dBi sensing antenna at the unlicensed device.[56] Additionally, Fixed/Access devices should be required to scan once per minute for a wireless microphone beacon that indicates which TV channels are in use by Part 74 devices at that location.

To minimize interference to other users, Fixed/Access devices should have a minimum directive gain of 8 dBi for VHF operation and 14 dBi for UHF operation. In addition, they should have a minimum front-to-back ratio of 15 dB for operation in either band. However, the use of directional transmitting antennas should not be considered an invitation to increase the radiated power beyond the limits specified here because wireless microphone receivers located in the path of the transmitting antenna will be very vulnerable to interference.

Professional Installation. Professional installation should be required for the Fixed/Access Point-to-Multi Point base station devices.[57] The base station equipment should be installed or inspected by a NARTE (National Association of Radio and Telecommunications Engineers) certified EMC engineer, an SBE (Society of Broadcast Engineers) certified Professional Broadcast Engineer, a Registered Professional Engineer, or similarly qualified person.

[55] Shure Comments at p. 31.
[56] *See, e.g.,* IEEE Comments at p. 13.
[57] IEEE Comments at p. 11; Motorola Comments at p. 9, n.13; Reply Comments of NARTE, Inc. filed in ET Docket No. 04-186 on January 11, 2005 at p. 3.

Identifier. Fixed/Access base station devices should transmit a unique identification (ID) signal to assist in resolving interference problems to incumbent services.[58] In order for incumbent users to easily determine the base station identity, the ID signal should be transmitted periodically, once per minute, and must be easy to decode without using a CPE device. Shure suggests the ID signal be transmitted using Frequency Shift Key (FSK) modulation that would allow demodulation by an inexpensive receiver. Because the ID signal would only contain a few bits of information, using FSK modulation would have very little effect on the throughput of the Fixed/Access network. The ID signal should contain the coordinates of the base station antenna that were determined and assigned when the equipment was installed. It is important that the ID signal message format and modulation, along with any coding, be standardized and made publicly available, along with being included in the standard being created by the IEEE 802.22 Working Group.

Out-of-Band Emissions. The out-of-band emissions limits for Fixed/Access devices should be lower than those specified in Section 15.209(a) to fully protect existing services. As indicated by Shure in its initial comments, the out-of-band power levels allowed by unlicensed devices can create interference to wireless microphones when the unlicensed device is located at a distance of only three meters from the microphone receiver. Operation of unlicensed devices at distances closer than three meters to wireless microphone receivers will cause create greater interference and likely completely mute the microphone system, preventing it from operating. Therefore,

[58] *See, e.g.,* WISPA Comments at p. 26.

Shure recommends that the out-of-band emissions levels required by Fixed/Access devices be at least 10 dB lower than the level specified in Section 15.209(a).[59]

Database Registration. Fixed/Access base stations should be required to be registered in a publicly accessible database available via the Internet to provide a means of resolving interference problems. The database should be updated once per day and should include operator contact information, positional and coordinate information, and information on operational changes to the stations.

Inspection. Due to the damaging effects of weather on outdoor antennas, the responsible party should inspect Fixed/Access Device installations every three years at a minimum to ensure that these devices are still operating properly and that the antennas are correctly oriented.

Technical Certification Bodies. New unlicensed device approvals should be granted directly by the FCC for at least the first three years, until greater experience can be gained in the performance and testing procedures. Technical Certification Bodies (TCBs) should be allowed to approve these new unlicensed devices only after the Commission has substantial experience demonstrating that a sufficient level of interference protection is, in fact, afforded to incumbent users.[60]

B. Personal/Portable Devices

Technical Parameters. Several parties commented on the need to proceed cautiously with introducing Personal/Portable devices and cited interference problems with television and cable devices to support their concerns.[61] Shure shares this view and notes that there are many important and unresolved issues regarding the

[59] *See* Motorola Comments at p. 12.
[60] *See* WISPA Comments at pp. 36-37.
[61] *See, e.g.*, CEA Comments at p. 5; MSTV Comments at p. 7.

capabilities and performance of Personal/Portable devices. The IEEE 802.22 Working Group has been formed to study and create a standard for Fixed/Access devices *only*. There is no equivalent body of experts currently studying either the interference problems Personal/Portable devices may cause to television and cable devices or wireless microphones, or how to resolve these interference issues. Until these issues are examined further and prototype devices are created and tested in real-world environments, no definitive assurances can be made regarding the actual levels of interference protection these devices will be able to provide.[62]

Therefore Shure urges the Commission to authorize Personal/Portable devices in the TV bands only after a sufficient body of data exists to resolve the interference problems other commenters have identified. Should the Commission conclude to authorize Personal/Portable devices before such proof is brought forward, Shure agrees with other commenters that advocate limiting the power levels of Personal/Portable devices to 20mW with a 0dBi integral antenna for bandwidths of 2.5 MHz or greater and 1mW with a 0dBi integral antenna for bandwidths of less than 2.5 MHz. Power must be measured on an RMS basis. As observed by other commenters, reducing the Personal/Portable device power limit below what was proposed in the NPRM is essential level to ensure adequate interference protection.[63] Personal/Portable devices should still be required to use continuous spectrum sensing to avoid interfering with wireless microphones at a sensing level of –107dBm (within a 200 kHz bandwidth) or greater using a 0dBi sensing antenna at the unlicensed device. Additionally, Personal/Portable devices should be required to scan once per minute for a wireless

[62] *See* Motorola Comments at p. 15.
[63] *See, e.g.*, CEA Comments at p. 5; Motorola Comments at App. B-4; Telex Comments at p. 4.

microphone beacon that indicates which TV channels are in use by Part 74 devices at that location.[64]

Identifier. Shure observes that there was little support for the Commission's proposal to require Personal/Portable or CPE devices to transmit a unique ID signal, primarily due to privacy concerns and a lack of utility in resolving interference problems.[65] Therefore, Shure believes this requirement should be abandoned.

Out-of-band Emissions. As with Fixed/Access devices, the out-of-band emissions limits for Personal/Portable devices should be lower than those specified in Section 15.209(a) in order to fully protect existing services. Due to the portable nature of Personal/Portable devices, the threat of interference to wireless microphones from out-of-band emissions is even greater from these devices because the location of unlicensed devices cannot be controlled relative to wireless microphone receivers. It is possible that someone could set a Personal/Portable unlicensed device directly on top of a wireless microphone receiver causing severe interference. Therefore Shure recommends that the out-of-band emissions levels required by Personal/Portable devices be at least 10 dB lower than the level specified in Section 15.209(a).

Technical Certification Bodies. As with the Fixed/Access devices, new Personal/Portable unlicensed device approvals should be granted directly by the FCC for at least the first 3 years, until more experience can be gained in the interference protection and testing procedures.

[64] *See* IEEE Comments at p. 14.
[65] *See, e.g.,* Intel Comments at p. 15; WISPA Comments at p. 18.

VI. IN ADDITION TO TECHNICAL REQUIREMENTS, THE COMMISSION CAN ALSO ADDRESS CERTAIN POTENTIAL RISKS POSED BY UNLICENSED DEVICES BY PHASING IN THEIR IMPLEMENTATION.

A. The Digital Television Transition Presents Real Hurdles for Unlicensed Device Implementation

Many commenters expressed the view that it is premature to proceed with allowing unlicensed devices in the TV bands before the DTV transition is concluded.[66] Cox, for example, argues that "the Commission should not open broadcast spectrum to [unlicensed] devices at least until the DTV transition is complete,"[67] observing that "[t]he technology necessary to ensure that unlicensed devices function properly in a congested spectrum environment and do not harm television viewers still is under development and likely cannot be proven reliable until the close of the DTV transition."[68]

If consumers find that DTV reception is sporadic or unavailable due to interference from unlicensed devices, DTV may not reach "critical mass," and may fail in the marketplace. MSTV explained this risk in its comments, stating that "[i]f consumers are subjected to harmful interference from unlicensed devices—even if such interference could eventually be corrected—they will see a frozen picture or blank screen. Such disruption could easily derail the digital transition, which is currently at a critical juncture in its development."[69]

Other services such as public safety and commercial broadband wireless are waiting to use spectrum vacated by analog TV stations, and are therefore dependent upon the success of DTV. Qualcomm notes that "allowing unlicensed devices on

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[66] *See, e.g.,* Harris Comments at p. 5 ("Harris recommends that the Commission complete its work in the DTV transition by finalizing the DTV channel allotments and adopting final technical rules for distributed transmission technologies prior to permitting unlicensed devices to operate in the television band.").
[67] Cox Comments at p. 2.
[68] *Id.*
[69] MSTV Comments at pp. 3-4.

Channels 5-36 and 38-51 could prolong the DTV transition by complicating the channel selection process and causing interference to TV sets."[70]

While the best way to keep unlicensed devices from adversely affecting the DTV transition would be heed the sage warnings of many commenters to wait to introduce unlicensed devices until after the DTV transition is complete,[71] the Commission may conclude to move forward with unlicensed devices notwithstanding the risks to DTV. A phased implementation may help reduce the risk of moving forward. Entravision, for example supports this view, recommending that "the Commission could agree to participate in a pilot program allowing the Commission and participants to evaluate this use of vacant spectrum."[72]

B. Similarly, Unless the Commission is Certain that Any Technical Fixes It Adopts Will Be Sufficient to Protect Existing Uses, the Commission Should Consider a Phased Implementation of Unlicensed Devices.

Phasing in unlicensed devices still enables the Commission to realize public interest benefits while protecting existing services consistent with the NPRM. Any "phase" timetables could be reviewed periodically or at a date certain in the future; for example, upon completion of the DTV transition or as part of the Commission's Triennial Review process.

Fixed/Access operation in defined rural areas may present fewer interference issues than other scenarios, provided that appropriate technical and operational constraints are applied. Introducing these types of unlicensed devices in rural areas first would provide the Commission a reasonable basis on which to proceed in higher

[70] Qualcomm Comments at i.
[71] *See, e.g.,* Entravision Comments at p. 7 ("it is premature for the Commission to consider permitting unlicensed operation in the TV bands until the DTV transition is complete").
[72] Entravision Comments at p. 8.

risk urban environments. In addition, the Commission may wish to consider developing a Fixed/Access test system under closely controlled conditions in a congested metropolitan environment to assess the nature and incidence of harmful interference and the effectiveness of interference mitigation measures.

The Consumer Electronics Association observes that "[f]or a variety of reasons, the introduction of the fixed access category of devices proposed by the Commission is less controversial than the personal/portable category."[73] More study of the interference potential of Personal/Portable devices is needed. It is noteworthy that the comments of IEEE deal primarily with Fixed/Access devices, and not Personal/Portable devices. The group was unable to devote sufficient study to Personal/Portable devices to enable it to make specific recommendations at this time. Thus, in light of the concerns about Personal/Portable devices combined with the lack of analysis devoted to them, a phased implementation of Personal/Portable devices would be prudent to ensure they do not cause wide scale interference to licensed services.[74]

VII. TO FACILITATE COMPLIANCE AND ENFORCEMENT, INTERFERENCE PROTECTION MEASURES AND TECHNICAL LIMITATIONS ON UNLICENSED DEVICES SHOULD BE CODIFIED IN THE COMMISSION'S RULES

In the event that the Commission decides to proceed with the introduction of unlicensed devices in the TV bands at this time, Shure believes it is critical that the new

[73] CEA Comments at p. 4 (also noting that the propagation characteristics of the TV band make it a "natural candidate" for rural broadband access).

[74] Some commenters also expressed the view that additional spectrum for Personal/Portable devices is not needed at this time particularly since the Commission recently made available an additional 255 MHz for these devices in the 5.6 GHz band. Qualcomm states that "[t]he NPRM simply asserts, with no evidence, that there is a need for additional unlicensed spectrum, and it leaps to the conclusion that allowing unlicensed devices to operate in the licensed TV bands is the best way to meet the need." Qualcomm Comments at ii. Further, Lanham Rattan argues that "it would be a good idea that some space is made available for ISP's only as there is already enough consumer equipment airspace." Brief Comment of Lanham Rattan filed in ET Docket No. 04-186 on November 30, 2004.

rules governing these devices include mandatory operational and technical protection requirements for incumbent services. Unless such requirements are codified into the Commission's rules, there will be little incentive for manufacturers to include these protections, with the undesired result being that consumers, the industry, and ultimately the Commission will likely have to deal with potentially serious and widespread interference problems on an ad hoc basis. Several commenters support this step.[75] For example, NSCA members state that "[i]t is essential that these safeguards be codified into the FCC Rules in order to be effective."[76] Similarly, IEEE states that "[i]n order to be effective, the simple requirements for detecting a beacon signal will need to be codified into the FCC rules."[77] Thus, to the extent the Commission allows unlicensed devices to operate in the TV bands, the Commission should codify into its rules the interference protection measures and other technical parameters unlicensed devices will be required to satisfy. This will facilitate the coexistence of unlicensed devices with licensed services, consistent with the NPRM.

VIII. CONCLUSION

The dual objectives stated in the NPRM are to allow unlicensed devices to operate in the TV bands as long as no harmful interference occurs to licensed services. However, as shown by Shure's technical analysis and by other commenting parties, the Commission's proposals do not adequately protect existing users of broadcast spectrum from harmful interference. Introducing "mass market" unlicensed devices only to have them interfere with licensed services would not serve the public interest. Thus, to the

[75] *See, e.g.*, Harris Comments at p. 7 ("Harris strongly supports [interference limiting techniques] and recommends that the Commission adopt rules enforcing such limitations.").
[76] Comments of NSCA filed in ET Docket No. 04-186 on November 30, 2004 at p. 2.
[77] IEEE Comments at p. 14.

extent the Commission concludes to allow unlicensed devices in the TV band, the Commission must significantly modify its proposed technical rules to provide greater interference protection in order to fulfill the objectives of the NPRM and avoid causing harmful interference to licensed services.

Should the Commission conclude to introduce unlicensed devices to the TV band, the best scenario would be a phased introduction of new unlicensed services beginning after the DTV transition has completed because this affords the industry adequate opportunity to build and test unlicensed devices for their ability to avoid interfering with incumbent services, in addition to developing interference protection measures. Further, Shure urges the Commission to adopt Shure's three-part interference mitigation solution as discussed herein and in Shure's initial comments. Shure's three-part interference mitigation solution is a "win-win" approach that fulfills the dual objectives of this proceeding by allowing unlicensed devices to operate in the TV

bands without causing harmful interference to important licensed services in the broadcast spectrum.

Respectfully submitted,

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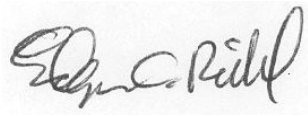

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